CSci 421
Introduction to Algorithms

Homework Assignment 5
Due: Wednesday 25, Feb 2004

Winter 2004 February 18, 2004

Reading in Chapter 7: 7.1–7.4, 7.6 (although I gave a different algorithm in lecture), 7.9–7.11, 7.13.
Homework:

1. Let $G = (V, E)$ be a connected undirected graph, and v a designated vertex of G. A depth first search of G starting at v may produce different results depending on the order in which edges are examined at each vertex. In particular, the set $T \subseteq E$ of edges categorized as "tree edges" by DFS (defining a spanning tree of G) may depend on the edge order.

   (a) Give an example of this, on a graph with $|V| \leq 5$.

   (b) We say a spanning tree T (with root v) "is a DFS tree for v" if there is an ordering of the edges of E incident to each vertex such that T is the tree constructed by DFS(v).

   Disprove: Every spanning tree is a DFS tree.

   (c) Give a necessary and sufficient condition for a spanning tree T rooted at v to be a DFS tree for v.

   (d) Give an efficient algorithm ($O(|E| + |V|)$ if possible) to determine, given G, v and a spanning tree T, whether T is a DFS tree for v.

2. 7.14. You may use *in*creasing DFS numbers and LOW values (as in lecture) rather than decreasing numbers/HIGH values (as in text) if you prefer. Say which you're doing.

3. 7.16. You may use *in*creasing DFS numbers and LOW values (as in lecture) rather than decreasing numbers/HIGH values (as in text) if you prefer. Say which you're doing.

4. 7.17. Is the same true if all cross edges are also removed? Prove it.

5. 7.38.